Activity: Fetal Development

In this activity, you will measure pictures of fetuses of various ages and make a data table. From this data and from data you are given concerning fetal mass, you will construct and interpret graphs of fetal size versus time.

Background:

Human Development

It takes 40 weeks for a fertilized egg to develop into a human infant. This amazing process involves millions of events that occur in a precisely timed and orderly sequence.

1. Most organs have begun to form in this embryo, which is about 5 weeks old and 1 centimeter (cm) long. The embryo’s heart—the dark, rounded structure in the photo—is beating. Notice that both the arms and legs are developing.

2. After 8 weeks, all body systems are present, and the embryo is called a fetus. Muscles move, the nervous system develops, and blood cell formation starts. This fetus is about 10 weeks old and weighs as much as an ordinary letter.

3. By 11 weeks, a fetus’s hands, arms, legs, and feet have reached their birth proportions. Notice the well-developed eyes, nose, and ears. This fetus is about 6 cm long.

4. By 22 weeks, a fine downy hair—including eyebrows—and a waxy substance covers the body. The fetus is about 30 cm long and has regular sleep patterns. When awake, the fetus is active, and the mother can feel the movement.

5. By 32 weeks, the fetus is fully developed. The bones have hardened, and the lungs and heart are ready for breathing air. As the fetus grows and runs out of space, it becomes less active. At birth, after 40 weeks, the average baby weighs 3.5 kilograms (kg).
**Fertilization** –
- Most likely to occur within a few days of ovulation
- Occurs in the fallopian tube (usually)
- Enzymes at the head of a sperm break down the thick outer layer of the egg
- Sperm (haploid) + egg (haploid) $\rightarrow$ zygote (diploid)

**Pregnancy** –
- Takes about 38 weeks or 9 months
- Development takes place in the uterus
- Divided into three **trimesters**

**The First Trimester** –
- After about 24 hours the zygote starts to divide in a process call **cleavage**
- During cleavage the zygote is traveling from the fallopian tubes to the uterus – cells are not growing
- After about 6 days, the zygote is a hollow ball of cells called a **blastocyst** – it implants itself into the built up uterine lining
- Zygote produces hormones that tell the mother to keep producing estrogen and progesterone – keeps the pregnancy going
- **Placenta** develops as a way for nutrients and waste to pass between mother and child – blood does not mix
  - Harmful substances such as nicotine, alcohol, bacteria and even caffeine can pass through the placenta and impact the development of the baby – often resulting in mental retardation such as fetal alcohol syndrome
- Blastocyst develops into three primary tissue layers (endoderm, mesoderm and ectoderm)
- Third week – 2mm – blood vessels begin to develop
- Fourth week – limbs and organs form

**The Second Trimester** –
- Period of rapid growth
- Mother feels movement

**The Third Trimester** –
- More rapid growth
- Less movement – it gets crowded in there
1. Measure the body length (rump to top of head), thigh length (rump to knee), and calf length (knee to foot) of each pictured fetus using the markings on the 38 week fetus as a guide. Each picture is only 4/10 as big as the actual fetus, so figure out a conversion factor to use to get the actual sizes of the fetuses. Record your results in a data chart that has the following headings: Fetal Age (weeks), Body Length of Picture (mm), Thigh Length of Picture (mm), Calf Length of Picture (mm), Total Length of Picture (mm) which is the sum of the previous three measurements, and Actual Total Fetal Length (mm).

<table>
<thead>
<tr>
<th>Fetal Age (weeks)</th>
<th>Body Length of Picture (mm)</th>
<th>Thigh Length of Picture (mm)</th>
<th>Leg Length of Picture (mm)</th>
<th>Total Length of Picture (mm)</th>
<th>Actual Total Fetal Length (mm)</th>
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2. Graph your data. *Time is the independent variable* and *Actual Total Fetal Length is the dependent variable*. Make sure to give the graph a title, to label each axis, and to give units. Graphs must be done in pencil.
3. Prepare graph based on the data given below concerning fetal weight. Make sure to **give the graph a title, to label each axis, and to give units**. Graphs must be done in pencil.

<table>
<thead>
<tr>
<th>Weeks of Fetal Development</th>
<th>Fetal Mass (grams)</th>
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<tbody>
<tr>
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<td>3300</td>
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4. Answer the questions below. You will need to interpret your graphs in order to answer certain questions. Others will require you to look up information in the textbook (991-1001). For some, you will have to think.

**Questions:**
1. How would a doctor get pictures of fetuses?

2. What factor did you use to calculate the actual sizes of the fetuses from the sizes of the pictures? Show or explain how you decided that was the right number to use.

3. During which weeks of development is the baby called an embryo? How much did the baby grow in length and mass during the time it was considered an embryo?

4. During which weeks of development is the baby called a fetus?

5. When did the fetus reach half of its final length?

6. When did the fetus reach half of its final mass?

7. Suppose a woman was not sure when she became pregnant. How could a doctor find out how advanced her pregnancy was? Why would it be important to know how far advanced the pregnancy was?

8. Why would a doctor want separate measurements of body, thigh, and calf?

9. Suppose a woman who knows she is in her 30th week of pregnancy has a fetus with a total length of 210 mm. and a mass of 900 gm. She tells the doctor that she has several beers every day. Explain how her drinking is affecting the development of her fetus.